

CLAIMS

WHAT IS CLAIMED IS:

1. A method to correct for errors in transit time measurements for ultrasonic signals, comprising:

- a) measuring times of flight for ultrasonic signals in a pipeline containing a fluid flow;
- b) calculating at least one diagnostic for said ultrasonic signals;
- c) comparing said at least one diagnostic to a set of respective expected values to determine whether values for said at least one diagnostic is less than, equal to, or greater than the respective expected values;
- d) determining whether one or more errors exist in said measurements for said times of flight dependent upon said comparing step;
- e) correcting for said one or more errors if said one or more errors includes misidentification of ultrasonic signal arrival time in at least one measurement for said ultrasonic signals.

2. The method of claim 1, wherein said step of measuring times of flight for said ultrasonic signals includes calculation of a time of arrival for each of said ultrasonic signals based on a first set of variables and said step of correcting for said one or more errors includes adjusting said first set of variables.

3. The method of claim 1, wherein said step of measuring times of flight for said ultrasonic signals includes calculation of a time of arrival for each of said ultrasonic signals based on a set of

target values and said step of correcting for said one or more errors includes adjusting said set of target values to default values.

4. The method of claim 3, wherein said target values are SPF, SPE, and %Amp.
5. The method of claim 1, further comprising:
 - f) activating an alert signal based upon said comparing step.
6. The method of claim 1, wherein said at least one diagnostic includes a calculation of Eta.
7. The method of claim 1, wherein said at least one diagnostic includes a calculation of turbulence.
8. The method of claim 1, wherein said at least one diagnostic includes a calculation of signal quality.
9. The method of claim 1, wherein said at least one diagnostic includes a calculation of at least one peak selection diagnostic.
10. The method of claim 1, wherein said at least one diagnostic includes a calculation of a speed of sound signature.

11. The method of claim 1, wherein said at least one diagnostic includes a calculation of a velocity signature.
12. The method of claim 1, wherein said at least one diagnostic includes a calculation of at least one velocity ratio between chords in said ultrasonic meter.
13. The method of claim 1, wherein said at least one diagnostic includes a calculation of a ratio for measured differences in times between said ultrasonic signals.
14. The method of claim 1, wherein said step of identifying said one or more errors includes identifying a permanent cycle switch.
15. The method of claim 1, wherein said step of identifying said one or more errors includes identifying an intermittent cycle switch.
16. The method of claim 1, further comprising identifying noise in the fluid flow.
17. The method of claim 1, further comprising identifying velocity pulsation in fluid flow through said ultrasonic meter.
18. The method of claim 1, further comprising identifying temperature stratification in fluid flow through said ultrasonic meter.

19. The method of claim 1, wherein said at least one diagnostic includes a calculation of at least one maximum-transit-time-minus-minimum-transit-time diagnostic.
20. A self-tuning ultrasonic meter, comprising:
- a spoolpiece through which travels a flow of fluid;
 - a first transducer to generate first ultrasonic signals generally against said flow of fluid and to receive second ultrasonic signals generally with said flow of fluid;
 - a second transducer to generate said second ultrasonic signals and to receive said first ultrasonic signals;
 - electronics to calculate arrival times for said first ultrasonic signals and said second ultrasonic signals and to determine the presence of errors in said calculations of arrival times by comparing a set of diagnostics to a set of values to establish the presence of deviation by said set of diagnostics from said set of values, said electronics correcting for said errors if they exist.
21. The self-tuning ultrasonic meter of claim 20, said set of values being predetermined.
22. The self-tuning ultrasonic meter of claim 20, said set of values being dynamic and based on historical data accumulated by said self-tuning ultrasonic meter.